

FABRICATION OF AN OFFROAD HYBRID VEHICLE

Bibin.C¹, Vinod Kumar.K¹ Muruga Pandi.D¹, Rup Chander.R²

¹Mechanical Engineering, RMK College of Engineering and Technology, Thiruvallur Dist, 601 206

² Chennai Poles Private Limited, Chennai

Corresponding author. bibinmech@rmkcet.ac.in

Abstract:

The main aim of our project is to hybridize off road vehicles such as tractors, tillers and other agricultural, military and commercial off road vehicles. Our system is based on the principle that vehicles need more torque while starting from stand still condition. Therefore, the vehicle automatically pulls lots of fuel from the tank during the start. Hence, we can understand that the total load on the vehicle in the first gear is the highest when compared to all the loads at all other gears. The hybrid system in our vehicle aims to reduce this load at the start. This is achieved by setting up a high torque dc motor. Thus at the start the motor runs along with the engine and reduces load on the engine. By doing this the petrol consumption by the engine at the start can be reduced. This system can also be made to run completely to support the engine at all gears so that the motor shares some of the load and engine's fuel consumption reduces.

Keywords – hybrid system, off road vehicle, motor, petrol consumption.

I. Introduction

An off-road vehicle is considered to be a type of vehicle, which is capable of driving on and off paved or gravel surface. It is characterized by having large tires with deep open treads, and a flexible suspension. Other vehicles that do not travel public streets or highways are generally termed as off-highway vehicles, including tractors, forklifts, and cranes etc. Off-road vehicles play an important role because of their scattered use and versatility. The three largest "4-wheelvehicle" off-road types of competitions are Rally, Desert Racing, and Rock crawling.

The three largest types of All Terrain Vehicle (ATV) / Motorcycle competitions are Motocross, Endure, and also Desert Racing like Dakar Rally and Baja 1000. The most common use of these vehicles is for sightseeing in areas distant from pavement. Higher clearance and higher traction vehicles enables access on trails and forest roads that have rough and low traction surfaces.

A hybrid vehicle uses two or more distinct power sources to move the vehicle. The term most commonly refers to hybrid electric vehicles (HEVs), which combine an internal combustion engine and one or more electric motors. However, other mechanisms to capture and use energy may also be included.

A. Identification of Problem

Off road vehicle system has only propulsion used for movement of it. To reduce the fuel consumption during the initial thrust of the off road vehicle. This is due to lack of the hybrid technology in the off road vehicles.

B. Fuel Consumption

The hybrid vehicle typically achieves greater fuel economy and lower emissions than conventional internal combustion engine vehicles (ICEVs), resulting in fewer emissions being generated. These savings are primarily achieved by three elements of a typical hybrid design: 1.Relying on both the engine and the electric motors for peak power needs, resulting in a smaller engine sized more for average usage rather than peak power usage. A smaller engine can have less internal losses and lower weight. 2.Having significant battery storage capacity to store and reuse recaptured energy, especially in stop-and-go traffic typical of the city driving cycle. 3. Recapturing significant amounts of energy during braking that are normally wasted as heat. This regenerative braking reduces vehicle speed by converting some of its kinetic energy into electricity, depending upon the power rating of the motor/generator.

C. Working of Hybrid vehicle

Hybrid electric vehicles use two propulsion units. These are an electric motor and an internal combustion engine. During vehicle motion, these two hybrid electric vehicle power sources are stepped in from time to time to achieve low fuel consumption and low greenhouse gas emissions. The main components of hybrid electric vehicles are the electric motor also used as a generator, the batteries and the coupling devices.

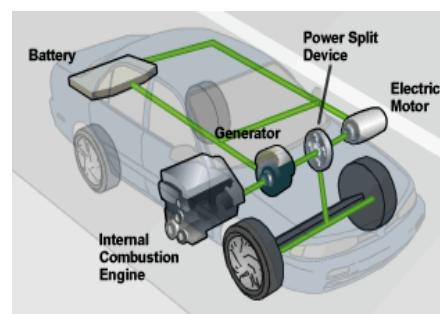
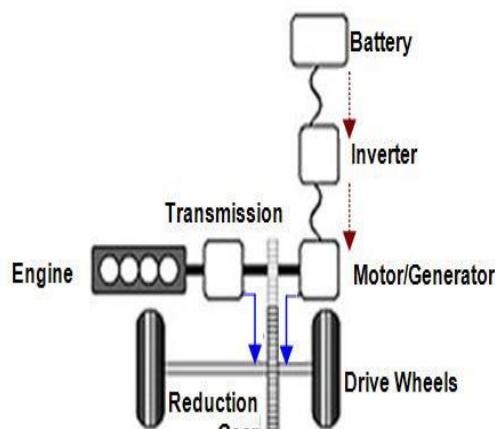


Fig.1 Working of HEV

D. Difference Between Parallel & Series Hybrid

Hybrid electric vehicles—HEVs—combine a gasoline-powered combustion engine with an electric motor to

offer a more environmentally-friendly driving experiences. Hybrid cars are classified according to the type of drivetrain or powertrain they feature, which determines how the engine and the motor work together to power the car. Parallel hybrids and series hybrids represent opposite ends of the spectrum and there are several key differences between these two types of hybrid drivetrains. While both parallel and series hybrids feature a gasoline engine, electric motor, rechargeable battery, inverter and transmission, they are configured in uniquely different ways. According to Hybrid Center, the engine in a series hybrid is smaller than a parallel hybrid while the electric motor and battery are larger. Series hybrids feature a separate generator which is connected to the engine. In a parallel hybrid, the electric motor acts as a generator. In a series hybrid, the gasoline engine is not coupled directly to the wheels, while it is in a parallel hybrid.



Parallel Configuration

Fig.2 Parallel configuration

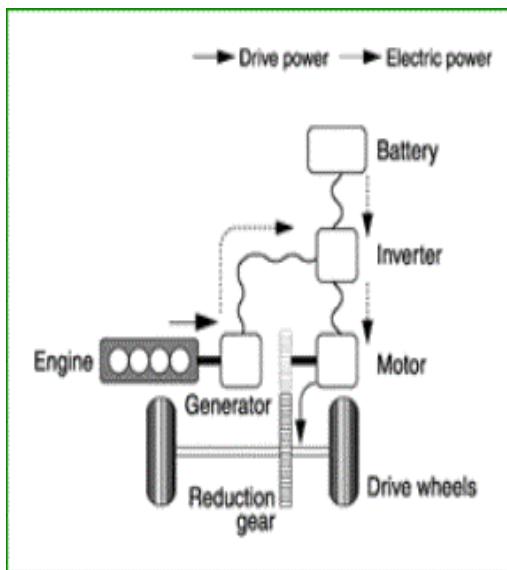


Fig.3 Series configuration

II. Proposed methodology

Before the reduction in fuel consumption was achieved by Hybrid technology. Vehicle to be run in off road requires more pull force but at lower fuel consumption. This can be achieved by Hybrid Technology.

III. E-REV



Fig.4 E-REV

IV. Working Principle

When the engine starts, a switch is turned on to start the motor. When the engine runs at the first and the second gear, the motor is synchronised with the speed of the engine by using a PWM speed controller. The motor will run only up to a particular speed in the second gear after which it is cut off by a speed sensor. After that whenever the engine comes to the first or second gear, the sensor switch operates the motor. Whenever the final drive shaft in the back axle runs the alternator coupled with it runs and generates current. When the motor is off and the engine is in third or any higher gear the shaft of the motor rotates at the same speed of the final drive. This makes the motor a generator. So from the start of the engine the alternator generates current and from the third gear the motor generates current. The current from the motor and the alternator goes to a commonly coupled battery.

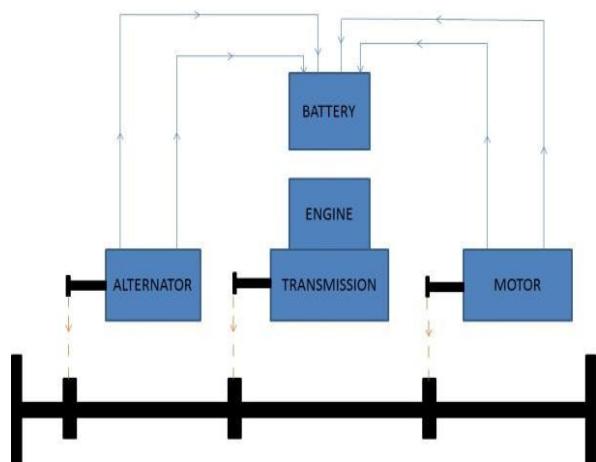


Fig.5 Hybrid System

A. Components of Hybrid Vehicle

- Chassis
- Front Axle
- Back Axle
- Engine& Transmission
- Motor
- Steering System
- Hybrid System

Table1. Engine Specification

Type	4-stroke, DTS-i, air cooled, single cylinder
Displacement	149 cc
Max. Power	15.06 @ 9000 (Ps @ RPM)
Max. Torque	12.5 @ 6500 (Nm @ RPM)
Transmission	5 Speed
Ignition Type	Self and Kick Start

V.Conclusion

We made this project entirely different from other projects. Since concepts involved in our project entirely different that a vehicle with hybrid technology is built over off road category, which is not developed by any other teams.

Thus, Fabrication of Off-Road Hybrid Vehicle was a completed successfully and was an impressing task in the field of automobile industry. The reduction of fuel consumption of the vehicle was attained.

By doing this project, we gained knowledge of various mechanisms, drives and fabrication such as welding, cutting, lathe operations and it is effectively useful for maintaining the fuel consumption low. This project was entirely a result of team work.

REFERENCE

- II. 1. Terramechanics and Off-Road Vehicle Engineering Terrain Behaviour, Off-Road Vehicle Performance and Design Author(s):J.Y. Wong, Ph.D., D.Sc.
2. Haxel, G, J. Hedrick, J. Orris (2002) - "Rare earth elements critical resources for high technology".
3. Garcia, J. (2008). Idaho Department of Environmental Quality- Retrieved November 22, 2009 from Air Quality: Vehicle Emissions and Air Quality: Deq.state.id.us

4. Shabna, John (2007-10-25). "GE's Hybrid Locomotive: Around The World on Brakes".

ACKNOWLEDGEMENT

We would like to thank **Mr. C.Bibin,M.E.(Ph.D)**, who inspired us and guided us to involve in research work. We would also like to thank **Dr.M. BALASUBRAMANIAN**, Professor, Head of the Mechanical Department, RMKCET for continuous motivation and support.

Biographies and Photographs

Mr.C.Bibin Associate Professor, He graduated in B.E (Mechanical Engineering) from Manonmaniam Sundaranar University in 2001, secured his master's degree (M.E Thermal) and MBA from Kamaraj University in 2002 and 2006 respectively, Currently Pursing Ph.D (IC Engines) in Anna University, Area of Research Interest Automobiles , Thermal , Alternate Fuels.



Mr.K.VinothKumar, Assistant Professor, He graduated in B.E (Mechanical Engineering) from Anna University in 2009 and Secured his master degree from Pondicherry university in 2013, Currently pursing Ph.D (Composite Material) in Anna university. Area of research work Composite materials, Metal Forming

